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गोल-सिरे वाली पत्ता गोभी के  
भण्डारण के लिए मार्गदर्शिका  
( पहला पुनरीक्षण )

Guide for Storage of  
Round-Headed Cabbage  
( First Revision )

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## FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Fruits, Vegetables and Allied Products Sectional Committee had been approved by the Food and Agriculture Division Council.

To ensure fuller utilization of perishable foodstuffs such as fruits and vegetables it is necessary that they should be preserved under conditions so as to maintain their fitness for fresh consumption over a period of time. Refrigeration is one of the important means to preserve these foodstuffs. For cold storage of various fruits and vegetables on scientific lines, a series of Indian Standard Guides are being issued. It is hoped that these guides stipulating the conditions to be maintained for different fruits and vegetables would prove to be helpful in better administration of cold storages and in preventing avoidable wastage of fruits.

This standard was first published in 1987 by adopting ISO 6000 : 1981, Round-headed cabbage — Storage in the open, identically under dual number system. The first revision of this standard is being brought out to align the conditions of storage of this produce with those prevailing in Indian scenario. Considerable assistance has been derived from the work carried out at the ICAR-Indian Institute of Horticultural Research, Bengaluru.

This Indian Standard provides guidance on storage of round-headed cabbage, however, because of the variability of the product according to the time and place of cultivation, local conditions may make it necessary to define other conditions for harvesting or other physical conditions in the store.

The application of the guidelines contained in this Indian Standard should enable much wastage in storage to be avoided and thus should enable long-term storage to be achieved in most cases.

The composition of the Committee responsible for the formulation of this standard is given at Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

*Indian Standard*

# GUIDE FOR STORAGE OF ROUND-HEADED CABBAGE

( First Revision )

## 1 SCOPE

This Indian standard describes conditions for successful cold storage of cabbages belonging to the species *Brassica oleracea* var. *Capitata* L intended for fresh consumption or for processing.

## 2 HARVESTING AND STORAGE CONDITIONS

### 2.1 Cultivars

Cabbage can be grown easily under a wide range of environmental conditions but cool moist climate is most suitable. Round headed cabbages are different from Chinese cabbages that are usually cylindrical in shape and less compact than round cabbages. The edible economic part of cabbages is generally referred as cabbage head.

The storage techniques described apply equally to all commercial cultivars of cabbage. Growing conditions like soil conditions and other environmental factors in various regions may have slight effect on storability. Late, slow growing cultivars are reported to be more suitable for storage and similarly those grown in light or semi compact soils.

### 2.2 Harvesting

#### 2.2.1 Maturity

Maturity of cabbage is usually based on compactness of the head. Cabbages are harvested when they are fully developed, firm and solid to the touch but before they crack or split. Fully developed heads attain a lighter shade of green and indicated by curling back of the cover leaves. Delay in harvesting even a few days beyond maturity results in split heads and increases incidence of field disease. However, harvesting immature loose heads reduces yield, and the heads are too soft to resist handling damage and have a shorter shelf life than mature heads.



FIG. 1 FULLY MATURE CABBAGE

#### 2.2.2 Method of Harvesting and Handling

The cabbage heads are harvested by cutting the stalk just below the bottom leaves with a sharp knife or sickle. The head should not be removed by snapping or twisting it as this method damages the head and results in inconsistent stalk length. Harvesting is done by bending it to one side to avoid any mechanical damage to the heads. The stalk should be cut flat and as close to the head as possible, yet long enough to retain two to four wrapper leaves. Extra leaves act as cushions during handling and may be desired in certain markets. Cabbage heads with broken stalks are more susceptible to decay. Harvested cabbage heads are placed in bags, boxes or crates and care has to be taken to prevent injuries due to bruising while handling. Harvested produce should not be exposed to direct sunlight as they are susceptible to wilting from high temperatures.

### 2.3 Pre-storage Operations of Sorting and Trimming

All the heads that are soft, immature, and diseased or damaged by caterpillars should be sorted out. The outer leaves of each head are trimmed for convenience in handling and better appearance. The outer leaves are trimmed, usually removing 3-6, together with any

diseased, damaged or necrotic leaves. Spoilage of heads can be effectively controlled by removing the affected leaves and close trimming removes most of the infection.



FIG. 2 HARVESTED CABBAGES

## 2.4 Storage

### 2.4.1 Quality Characteristics for Storage

Cabbages should be handled carefully from field to storage and only solid heads with no yellowing, decay or mechanical injuries should be stored. All loose leaves should be trimmed away before storing. All cabbage heads intended for storage shall be whole, fresh in appearance, undamaged, sound and healthy, clean, and in particular free of soil and traces of water.

### 2.4.2 Packaging

Proper packing and cooling are essential to maintain the freshness of cabbages. It is highly advisable to use plastic crates/cartons instead of using mesh bags as these bags offer only minimal protection from rough handling. Crates and cartons are also easier for staking or palletizing.

### 2.4.3 Precooling

As cabbages are sturdy, it is usually not necessary to cool cabbage by rapid means of pre-cooling. But forced-air cooling can be used if the same is available as it can help in reducing the refrigeration load on the regular cold storages.

## 2.4.4 Optimum Storage Conditions

### 2.4.4.1 Temperature

The optimum storage temperature is from 0 °C to +1 °C. It is necessary to ensure that the temperature in the storage rooms does not fall below freezing point. Freezing injury appears as darkened translucent or water-soaked areas that will deteriorate rapidly after thawing. Freeze damage can occur if cabbages are stored below -0.1 °C. At higher than recommended temperatures, storage life will be shorter.

### 2.4.4.2 Relative humidity

The optimum relative humidity is from 90 to 95 percent. Excessive transpiration/moisture loss is the greatest source of postharvest damage to quality. The rate of water loss rises with decreasing relative humidity levels.

### 2.4.4.3 Air circulation

Air circulation in the storage room should be sufficient (60-80 air circulations/hour) to maintain constant and uniform temperature and RH around all cabbage heads. The package containers and the way in which they are stacked should permit free circulation of air. Good air circulation with continuous supply of fresh air will minimize surface molds and avoid accumulation of odors and volatiles contributing to off flavours.

### 2.4.4.4 Storage life

Cabbage heads can be stored successfully for 2 to 2.5 months when constant temperature is maintained continuously throughout storage. Inner lining of plastic crates with polythene sheet will help in maintaining the freshness and reducing the moisture loss. After storage the heads should be trimmed again to remove loose, wilted or damaged leaves. Storage for longer duration usually results in extensive trimming of heads to remove deteriorated leaves.

As cabbages are sensitive to ethylene, avoid storing cabbage with any product that emits more ethylene. The presence of small amounts of ethylene gas will accelerate senescence leading to premature yellowing, abscission of leaves and increase deterioration. Adequate ventilation during storage is also important to maintain very low ethylene levels.



FIG. 3 TRIMMING OF HARVESTED CABBAGES

## ANNEX A

( Foreword )

## COMMITTEE COMPOSITION

Fruits, Vegetables, and Allied Products Sectional Committee, FAD 10

<i>Organization</i>	<i>Representative(s)</i>
ICAR-Indian Institute of Horticultural Research, Bengaluru	DR M. R. DINESH ( <b>Chairman</b> )
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Review of Indian Standards Related to Storage, Transport and Ripening of  
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Amend No.	Date of Issue	Text Affected

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